Title: The Mouse Trap Design Challenge

Brief Overview:

The students will be given a mousetrap vehicle kit and other material. Using only the given material, the students will design and construct a vehicle that will travel the furthest distance and the fastest speed over a set distance.

Links to NCTM 2000 Standards:

- **Mathematics as Problem Solving**
  The students will use mathematics in the design, construction, and testing of a prototype vehicle.

- **Mathematics as Reasoning and Proof**
  Based on the measured performances of the class, the students will use graphs to determine the best design elements.

- **Mathematics as Communication**
  The students will use standard technical drawing practices to develop the design of the prototype and written evaluations to describe its performance.

- **Mathematics as Connections**
  The students will utilize scientific principles of potential and kinetic energy, simple machines, and basic engineering practices in combination with related mathematical formulas to develop the design of the prototype vehicle.

- **Algebra**
  The students will utilize formulas and equations to calculate the actual speed of the vehicle and the scale speed of the vehicle.

- **Measurement**
  The students will reinforce basic measurement skills, as well as scale measuring, in the design and evaluation of the prototype

Links to National Science Education Standards:

- **Science as Inquiry**
  The students will apply the basic principles of the Scientific Method and the Systems Approach to Problem Solving and compare the two methods.

- **Physical Science**
  The students will utilize and apply the principles of gears and pulleys, wheels and axles, levers, and other simple machines in a hands-on application.

- **Science and Technology**
  The students will apply basic scientific concepts to solve a practical problem.

Grade/Level:

Grades 6 - 8

Duration/Length:

6 to 8, 45 min. class session

Prerequisite Knowledge:

Students should have working knowledge of the following skills :

- Basic measurement
- Basic arithmetical skills: simple addition, subtraction, multiplication, and division
- Common fractions

Student Outcomes:

Students will be able to:

- develop an understanding of the systems model for problem solving.
- utilize basic mathematical skills in combination with science concepts to develop a solution to a given problem-
- compare results and using a mathematical concept project results from the model to real-life.

Materials/Resources/Printed Materials:

- Mousetrap vehicle kits (kit includes all worksheets and directions for construction of the vehicle)
- Graph paper
- Low temperature hot glue guns and glue sticks
- Scissors
- Stopwatch or other timing device
- Tape measure

Development/Procedures:

Using the mousetrap vehicle kits, each student is to design a vehicle that will travel the greatest distance possible, and also the fastest speed over the first 2 feet of travel. Have the students:

- discuss their design process with the class.
- discuss their systems approach to problem solving.
- identify the limitations of the problem.
- identify key design factors.
- brainstorm designs and choose a final design to develop fully.
- construct the vehicle from the given materials.
- test each vehicle after construction.
- calculate the speed of the vehicle over the distance of 2 ft. in feet per second.
- compare the wheel base of the prototype vehicle to the average wheel base of a full-size car.
- use the wheel bases and project the vehicles speed if it were a full-sized car.
- compare different design features and performance results for both speed and distance using a graph developed by the students.

Assessment:

A rubric can be developed to include the design of the vehicle, construction, and overall performance. For example, a 1- 4 in each area (see attached rubric).

Extension/Follow Up:

- Students can identify the science and mathematical concepts they used.
- Students can predict the effect of a vehicle's performance based upon data collected.
- Students can suggest changes in the design of their own vehicle based upon data collected.
- Students can, if time and materials allow, build a second vehicle and test it to see if it performs as predicted.

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Rubric

Vehicle Design	4 Sketches and drawings are accurate, specific, and fully detailed.	3 Sketches and drawings are accurate, specific, and mostly developed.	2 Sketches and drawings are somewhat accurate and specific.	1 Sketches and drawings are inaccurate and underdeveloped.
Vehicle Construction	4 Vehicle is constructed according to all required specifications and the developed plans.	3 Vehicle is constructed according to most required specifications and the developed plans.	2 Vehicle is constructed according to few required specifications and the developed plans.	1 Vehicle is not constructed according to required specifications and the developed plans.
Overall Performance	4 Vehicle performed well according to plans and specifications.	3 Vehicle performed mostly according to plans and specifications.	2 Vehicle performed somewhat according to plans and specifications	1 Vehicle did not perform according to plans and specifications.